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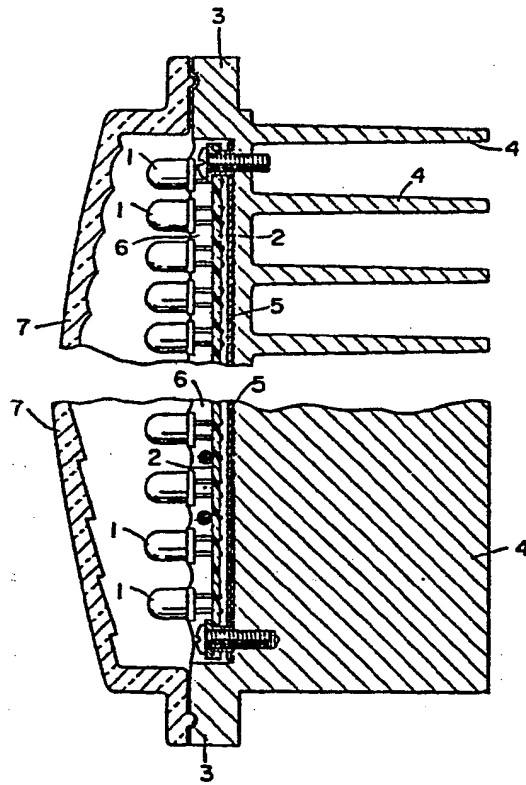
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(64) **SIGNAL LIGHT UNIT HAVING HEAT DISSIPATING FUNCTION.**

(57) A signal light unit having a heat dissipating function includes a heat radiator member (4) which is formed of a material having good thermal conductivity. The heat radiator member (4) is disposed on the reverse side of a base (3) in which are arranged a multiplicity of light-emitting diodes (1) serving as a light source of the signal light. The heat radiator member (4) is generally constituted by an assembly of fins. It is not always necessary to provide the heat radiator member (4) integrally with the reverse surface of the base (3). An endothermic member (12) may be interposed between the heat radiator member (4) and the reverse surface of the base (3).

FIG. 4



## DESCRIPTION

1. TITLE OF THE INVENTION

A Signal Light Unit Having Heat Dissipating Function

2. FIELD OF THE INVENTION

This invention relates to a signal light unit which has a signal light that uses as the light source a number of light-emitting diodes (LEDs) arrayed in the form of a plane and which has a function to effectively dissipate heat of large calorie generated inside the light unit.

3. BACKGROUND OF THE INVENTION

Conventionally, signal lights have been proposed that use as the light source a number of LEDs arrayed in a plane on a board for the purpose of energy saving. LEDs, however, have a low electricity-to-light conversion efficiency and change most of the electricity to heat despite of their high illumination efficiency and energy saving effectiveness. When used collectively in a large number at a time, therefore, LEDs generate a substantially large calorific power. In addition, LEDs have a negative temperature coefficient of light emission, so that their illumination decreases as the ambient temperature rises; for example, the light intensity is halved at an ambient temperature of 80°C as compared with that at 25°C. To keep a high illumination efficiency of LEDs, therefore, their own temperature must be kept low.

The abovementioned conventional signal light which uses many LEDs has such a fault that the LEDs arrayed as many as meet a prescribed illumination standard as the light source generate a substantially large calorific power when they are energized at the same time. As a result, not only the illumination efficiency of the LEDs will lower but also their service life will shorten, thus resulting in a failure as a signal light unit.

This invention solves the problem of such fault with a purpose of providing a signal light unit that has a heat dissipating function that can dissipate effectively the heat generated inside the LEDs to open air through a heat sink located on the back face of the board on the right face of which many LEDs are arrayed in a plane, thus preventing lowering of the light emission efficiency of the LEDs by heat and reverse effects of heat on the signal light.

#### 4. DISCLOSURE OF THE INVENTION

The signal light unit of this invention comprises heat sink fitted on the back face of a board on the right face of which many LEDs are arrayed as the light source of the signal light. The heat sink efficiently induces and dissipates the heat of LEDs generated in the signal light unit to open air. This type of heat sink is generally formed as an aggregate of many fins. However, it need not always be fitted directly on the back face of the abovementioned board as one piece but can be indirectly connected to the back face with a heat absorb r placed between them.

## 5. BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings, there is shown a signal light unit embodying this invention which has a heat dissipating function of this invention. FIG. 1 is a top view, FIG. 2 a side view, FIG. 3 a sectional view along lines III-III of FIG. 1, FIG. 4 a fragmentary enlarged vertical section and a fragmentary enlarged traverse cross section of FIG. 1, and FIG. 5 different schematic structural representations embodying this invention for use of a signal light unit having a heat dissipating function of this invention as a traffic signal light equipment.

## 6. THE MOST PREFERABLE EMBODIMENT OF THE INVENTION

This invention will be better understood from the following description taken in connection with the accompanying drawings.

As shown in FIGS. 1 to 4, part 1 is an LED used as the signal light source, part 2 a printed circuit board (PCB) on which many LEDs 1 are arrayed in a plane and connected electrically, and part 3 a board constructed in one piece with a finned heat sink 4 on its back face. On the right side of board 3, an insulation sheet 5 is fitted, and on the sheet the PCB 2 to which many LEDs 1 are fitted in array is fixed with resin filler 6. Then, on the right face of board 3, a lens 7 is mounted.

The heat generated by LEDs 1 on the right face of board 3 is

led to heat sink 4, provided on the whole back face of board 3 so that the heat can be efficiently dissipated from all the surface of the heat sink. Heat sink 4 need not always be placed directly on the back face of board 3 but can, for example, be connected to board 3 through such heat absorber as heat pipes, as described later, or can be constructed in combination with an air blower such as fan for improvement of its heat dissipation effect. Furthermore, heat sink 4 is preferably made of aluminum or any other metal having a good thermal conductivity.

FIG. 5 is embodiment in which a signal light unit of this invention is used as a traffic signal light. Drawings (A) and (B) in FIG. 5 are another embodiment in which heat sink 4 is formed in one piece with the back face of board 3, the signal light unit of such structure is fitted on the front face of a traffic signal light box 8 and a hood 9 is fixed on the upper outside of light box 8 so that the signal unit in the light box can be cooled by use of heat sink 4. As in drawing (B), the ventilation effect of light box 8 can be improved by means of draft holes 10 provided on the back side of the box.

Drawings (C) and (D) show the structure in which an air blower as fan is used to send air to heat sink 4 in order to improve the heat dissipation effect; drawing (C) is of a method of

directly sending air from blower 11 to heat sink 4, while drawing (D) is of a method of sending air from blower 11 to heat sink 4 through draft holes 10 made in light box 8 to improve convection of air in the box. Those four methods of drawings (A) through (D) are preferable when the light emitting part comprising LEDs 1 generates large calorific power or when heat sink 4 is rather small as compared with the light emitting part.

Drawings (E) and (F) show the structure in which heat sink 4 is, separately from the back face of board 3, placed on the outside or outer surface of light box 8 to be exposed to open air and indirectly connected to the back face of board 3 with heat absorber 12, such as of heat pipes, placed between heat sink 4 and board 3, so that a separation between the heat absorbing part and the heat dissipating part will make easy heat insulation or setting of temperature difference for higher heat dissipation effects. Further, in traffic signal light equipment having two or more signal light units, the heat generated by the light units can be, as shown in (3) of drawing (E), gathered into heat absorber 12 common to the light units, and it is also possible to locate heat sink 4 outside light box 8 with the aim of size reduction.

## 7. INDUSTRIAL APPLICATIONS

As mentioned above, the signal light unit having a heat

dissipating function of this invention is suitable for small-sized energy-saving traffic signal light equipment to be introduced in place of the conventional traffic signal light equipment that is generally installed along the road and which employs incandescent lamps as its light source.



WHAT IS CLAIMED IS:

1. A signal light unit having a heat dissipating function which comprises a heat sink placed on the back face of a board on the right face of which a number of LEDs are arrayed.
2. A signal light unit having a heat dissipating function as claimed in Claim 1 in which the heat sink is finned.
3. A signal light unit having a heat dissipating function as claimed in Claim 1 or 2 in which the heat sink is formed in one piece with the back face of the board.
4. A signal light unit having a heat dissipating function as claimed in Claim 1 or 2 in which the heat sink placed outside the light box or on the outside surface of the light box is indirectly connected to the back face of the board with a heat absorber placed between them.
5. A signal light unit having a heat dissipating function as claimed in Claim 1 or 2 in which an air blower such as fan is installed in the light box.

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FIG.1

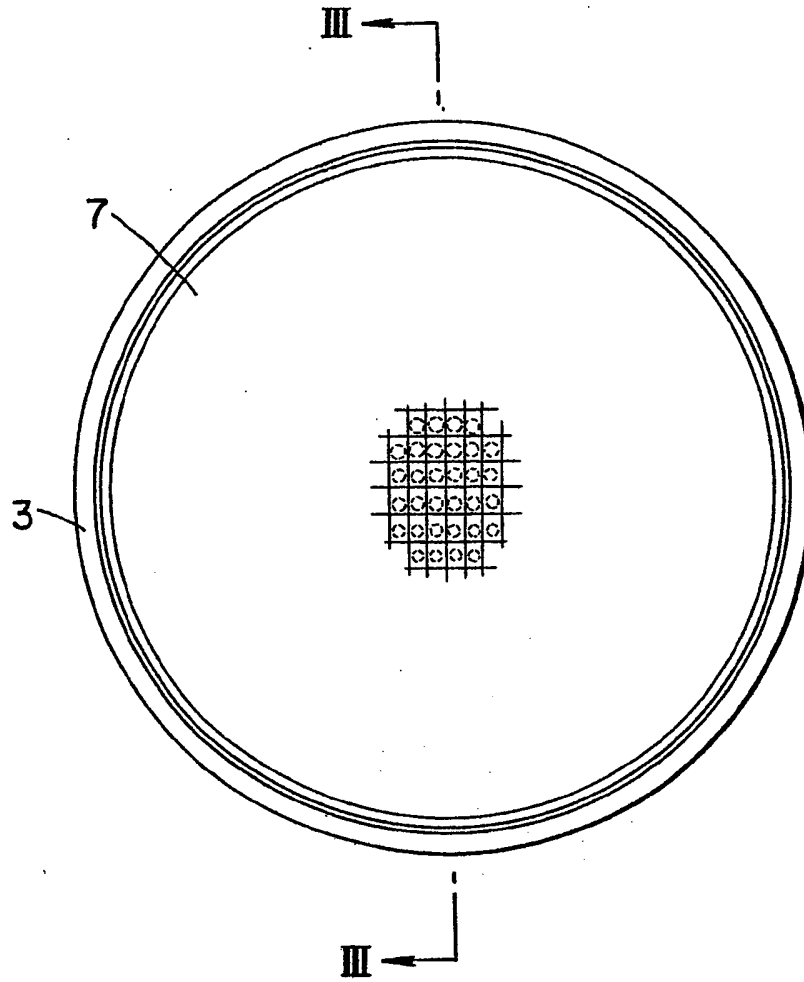
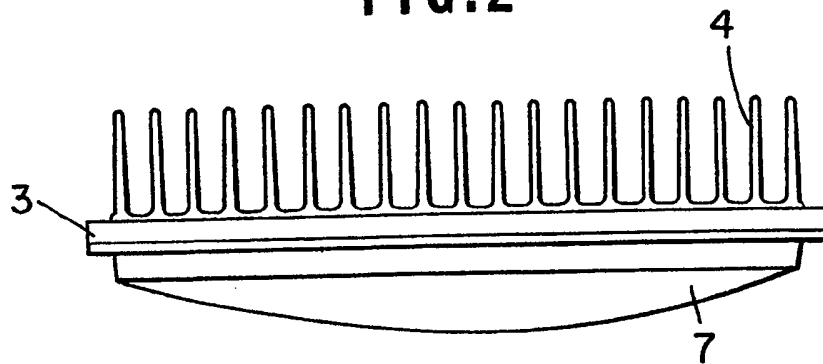
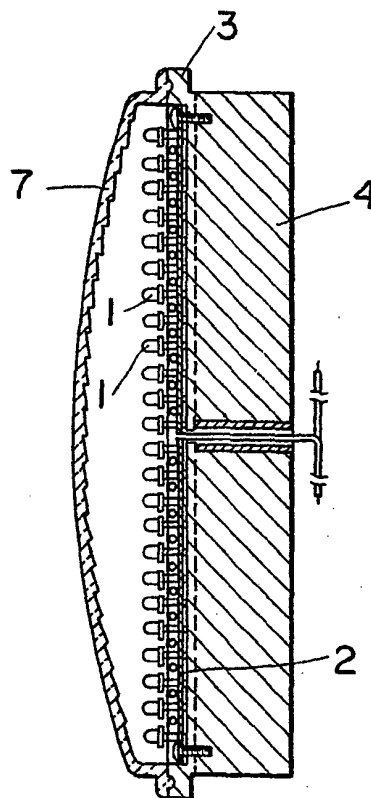


FIG.2



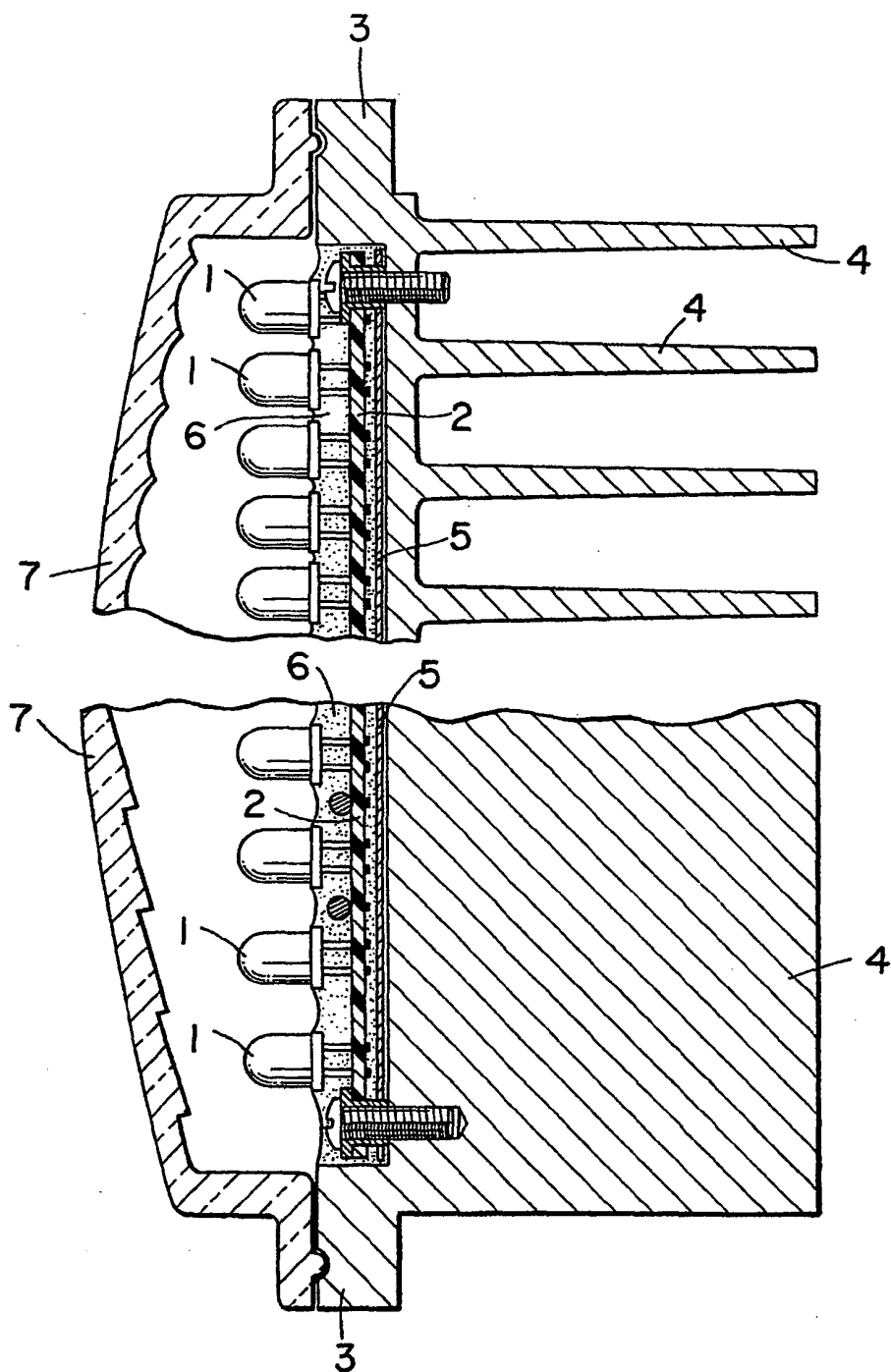
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FIG.3



3/5

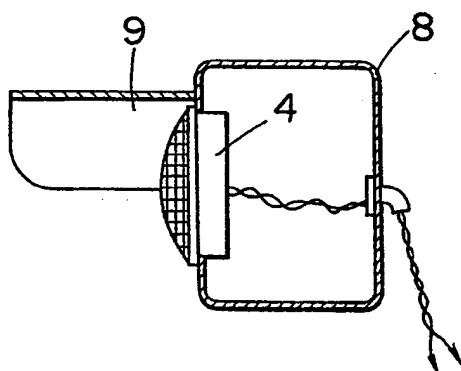
FIG. 4



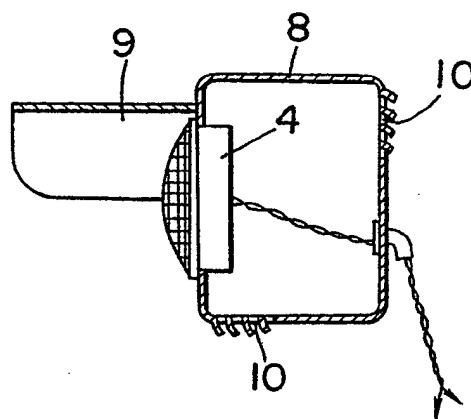
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FIG. 5

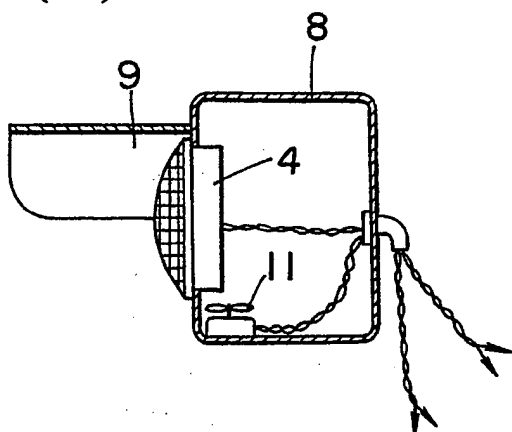
(A)



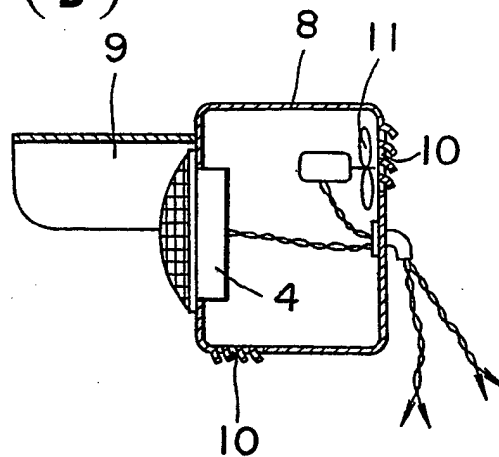
(B)

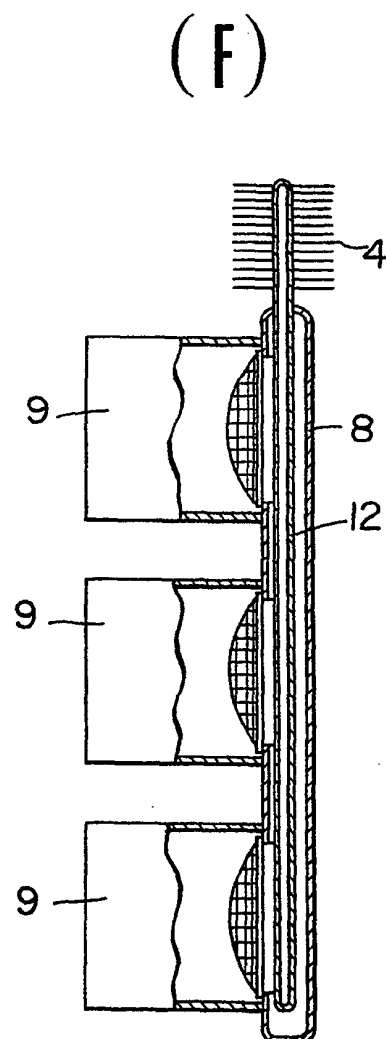
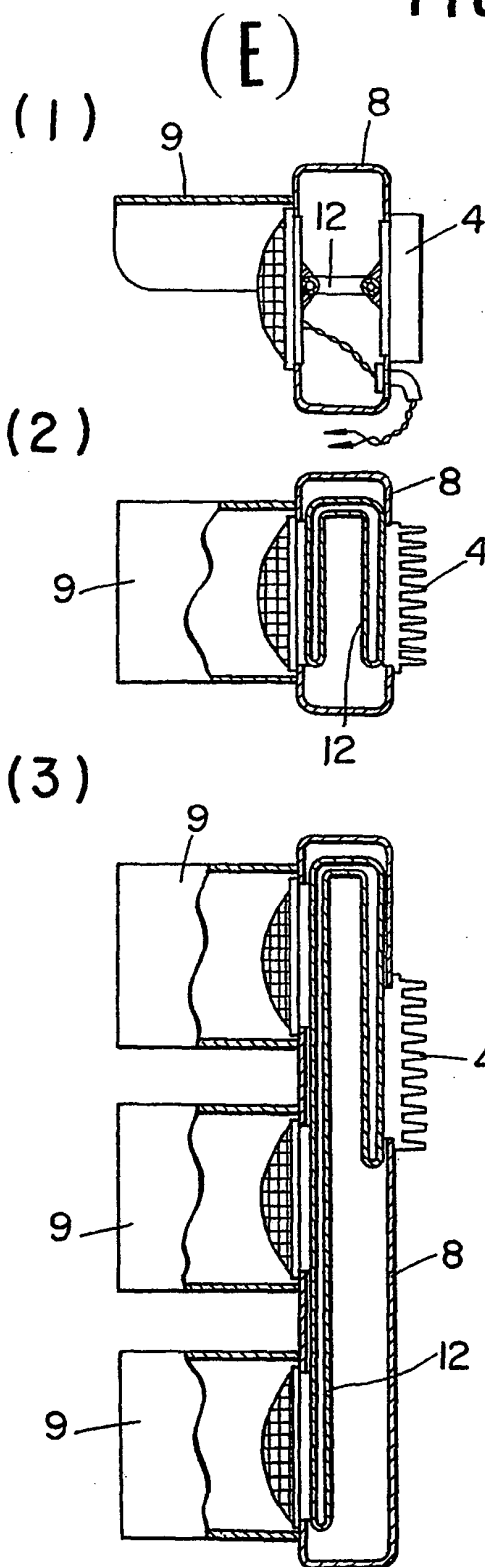


(C)



(D)



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FIG. 5

## INTERNATIONAL SEARCH REPORT

0202335

International Application No. PCT/JP84/00548

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>1</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.C1 <sup>3</sup> F21Q 3/00, F21V 29/00, G09F 13/20, H01L 33/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
IPC	F21Q 3/00, F21V 29/00, G09F 13/20, H01L 33/00	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>		
Jitsuyo Shinan Koho 1926 - 1984 Kokai Jitsuyo Shinan Koho 1971 - 1984		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>7</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
X	JP, U, 59-119487 (Mitsubishi Electric Corp.) 11 August 1984 (11.08.84)	1-3, 5
X	JP, U, 57-40963 (Ricoh Co., Ltd.) 5 March 1982 (05. 03. 82)	1, 3
Y	JP, U, 52-115171 (Matsushita Electric Works, Ltd.) 1 September 1977 (01. 09. 77)	4
<p><sup>15</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>2</sup>		Date of Mailing of this International Search Report <sup>3</sup>
November 29, 1984 (29. 11. 84)		December 17, 1984 (17. 12. 84)
International Searching Authority <sup>1</sup>		Signature of Authorized Officer <sup>20</sup>
Japanese Patent Office		